the interior of the patient, such as a computed tomography image. The predicted result of therapy is displayed for decision support.

[0170] The display **130** is a CRT, LCD, projector, plasma, printer, tablet, smart phone or other now known or later developed display device for displaying the output, such as an image with an outcome prediction.

[0171] The scan data, training data, network definition, features, machine-learned network, segmentation, radiomic feature values, non-image data, outcome, and/or other information are stored in a non-transitory computer readable memory, such as the memory **134**. The memory **134** is an external storage device, RAM, ROM, database, and/or a local memory (e.g., solid state drive or hard drive). The same or different non-transitory computer readable media may be used for the instructions and other data. The memory **134** may be implemented using a database management system (DBMS) and residing on a memory, such as a hard disk, RAM, or removable media. Alternatively, the memory **134** is internal to the processor **132** (e.g. cache).

[0172] The instructions for implementing the training or application processes, the methods, and/or the techniques discussed herein are provided on non-transitory computer-readable storage media or memories, such as a cache, buffer, RAM, removable media, hard drive or other computer readable storage media (e.g., the memory **134**). Computer readable storage media include various types of volatile and nonvolatile storage media. The functions, acts or tasks illustrated in the figures or described herein are executed in response to one or more sets of instructions stored in or on computer readable storage media. The functions, acts or tasks are independent of the particular type of instructions set, storage media, processor or processing strategy and may be performed by software, hardware, integrated circuits, firmware, micro code and the like, operating alone or in combination.

[0173] In one embodiment, the instructions are stored on a removable media device for reading by local or remote systems. In other embodiments, the instructions are stored in a remote location for transfer through a computer network. In yet other embodiments, the instructions are stored within a given computer, CPU, GPU or system. Because some of the constituent system components and method steps depicted in the accompanying figures may be implemented in software, the actual connections between the system components (or the process steps) may differ depending upon the manner in which the present embodiments are programmed.

[0174] In a further embodiment, the image processor **132** is configured to estimate a dose for the therapy from a regression relating the dose, a time-to-event, and the result. The dose is estimated from the regression so that the result is below a threshold probability of failure at a given value of the time-to-event. The regression is a calibration from a cohort used to train the multi-task trained network or a different cohort. The regression or calibration is a nomogram relating the dose, the time-to-event, and the result in one embodiment, but other representations may be used. In the regression, the dose is modeled as a continuous variable. The regression is based on estimation of a cumulative incidence function, but other functions may be used.

[0175] Any threshold probability may be used, such as 5% probability of failure. Probability of success, no death, and/or no recurrence may be used.

[0176] The regression may be for all patients. Alternatively, the regression is for a category of patients. A patient is identified as belonging to a particular category, such as histological subtype. The regression for that category is used to estimate the dose providing the result in the given value (e.g., 12 months) for the time-to-event.

[0177] The display **136** is configured to display the estimated dose. The estimated dose may be displayed in an image with other information, such as displaying a report having the estimated dose with or without an estimation of local failure probability at a configurable point in time. The report may include other information, such as a physician selected or prescribed dose and corresponding estimation of local failure probability for the physician selected dose.

[0178] Various improvements described herein may be used together or separately. Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the invention is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention.

What is claimed is:

1. A method for decision support in a medical therapy system, the method comprising:

acquiring a medical scan of a patient;

generating a prediction of outcome from therapy for the patient, the outcome generated by a machine-learned multi-task generator having been trained based with both image feature error and outcome error;

determining a dose for the patient based on a calibration relating the outcome, the dose, and a time-to-event; and

displaying a report including the dose.

2. The method of claim **1** wherein determining comprises determining based on the calibration being a regression from a cohort used to train the machine-learned multi-task generator.

3. The method of claim **2** wherein determining based on the calibration being a regression comprises determining where the regression is a Fine and Gray regression

4. The method of claim **1** wherein determining comprises determining the dose wherein the outcome has a probability of failure of less than a configurable percentage

5. The method of claim **1** wherein determining comprises determining with the calibration being for a histological subtype for the patient.

6. The method of claim **1** wherein determining comprises determining with the dose modeled as a continuous variable in the calibration.

7. The method of claim **1** wherein determining comprises identifying the dose as providing the outcome in a given value for the time-to-event.

8. The method of claim **1** wherein determining comprises determining with the calibration comprising a nomogram.

9. The method of claim **1** wherein determining comprises determining with the calibration, the calibration based on estimation of a cumulative incidence function.

10. The method of claim **1** wherein displaying the report comprises displaying the dose as a suggested dose with an estimated failure probability for the suggested dose and further comprises displaying a physician prescribed dose and an estimated failure probability for the prescribed dose.

11. A medical imaging system for therapy decision support, the medical imaging system comprising: